

## **LIQUID ACTIVATED DEVICES**

**0001** The invention relates to devices that are activated by a conductive liquid. In particular, this invention is directed devices for use in toys that are activated by a conductive liquid such as water.

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### **BACKGROUND OF THE INVENTION**

**0002** There are numerous types of toys available for children. Toys that exhibit a higher play value are more desired and will be more successful. Some toys that have enhanced play value interact with water and are designed to be used in a water environment.

10 **0003** One way in which the play value of toys can be enhanced is by incorporating a conductive liquid, such as tap water, into the play of the toy.

**0004** U.S. Patent No. 4,347,683 describes a conductive fluid activated device for use in toys. The device includes resistive responsive circuitry adapted to produce various sounds or to control electric components such as motors, solenoids and the like. A reservoir in a toy is provided with electrical probes that are activated by water when the water comes in contact with two probes simultaneously, thus forming a closed circuit. In some cases, more than one set of probes is provided within the reservoir in different positions. Thus, the orientation of the reservoir in space will cause liquid contained therein to activate different pairs of probes.

15 **0005** U.S. Patent No. 5,939,983 describes a toy that activates an indicator while an end user consumes an edible substance. The toy includes a first electrode and a second electrode that are connected to the indicator. An electrical path is created between the first and second electrodes, while the end user is consuming the consumable substance, to close an electrical circuit with the indicator. The circuit can be closed by the end user themselves or by displacement of the consumable substance (i.e. a straw that houses the first and second electrodes).

20 **0006** One type of toy that is particularly suited for play with water is dolls. Since dolls replicate babies, it is often desirable to have dolls simulate baby behaviour, including baby behaviours that involve a liquid (i.e. crying, wetting, drinking and bathing). U.S. Patent No. 5,094,644 describes a doll that has a delayed and wetting function. The doll comprises two

reservoirs and a siphon tube between the reservoirs. Feeding the doll liquid will result in the liquid flowing into one reservoir and then the other via the siphon tube. In one embodiment of this invention, a sound generator is enabled by a pair of electrical contacts within the siphon tube. The presence of water between the contacts will thus actuate a crying sound.

- 5   **0007** More complex liquid activated devices will allow for more sophisticated responses to the presence of liquid. In toys, this would result in a higher play value. There is therefore a need to develop improved liquid activated devices.

### **SUMMARY OF THE INVENTION**

- 10   **0008** According to one broad aspect of the invention, a device is provided, comprising a plurality of conductive probe pairs, a control unit coupled to said probe pairs, and a power source to supply said control unit with power, wherein each of said probe pairs is activated when bridged by a conductive liquid thus forming a closed circuit, said control unit registers activation of said probe pairs and said control unit is designed to actuate at least one pre-determined  
15   response, said response being dependent on the order in which each of said probe pairs is activated. The invention is particularly suited for use in toys.

- 0009** One advantage of the present invention is that an article made with the device of the present invention can be used to enhance the play value thereof by allowing its use in and with water and hence into the play environment. This is particularly advantageous for dolls as it is  
20   often usual for dolls to simulate babies and such simulation is often enhanced by the ability to incorporate liquids for actions such as drinking, wetting, crying and bathing.

- 0010** A further advantage of the present invention is that the device is able to detect not only the presence of but also the direction of flow of water. This is important as it is often desirable to trigger different actions depending on the direction of the flow of water.

- 25   **0011** According to another broad aspect of the invention, a toy is provided comprising: a cavity, at least one aperture in the toy that allows for the movement of liquid from the exterior of said toy into said cavity and a device housed within said cavity comprising: a plurality of conductive probe pairs, a control unit coupled to said probe pairs and a power source to supply

said control unit with power, wherein each of said probe pairs is activated when bridged by a conductive liquid thus forming a closed circuit, said control unit registers activation of said probe pairs and said control unit is designed to actuate at least one pre-determined response, said response being dependent on the order in which each said probe pair is activated.

5    **0012** According to another embodiment of the invention, the device comprises at least one conduit comprising at least one opening, a plurality of conductive probe pairs disposed within said conduit, a control unit coupled to said probe pairs and a power source to supply said control unit with power, wherein each of said probe pairs is activated when bridged by a conductive liquid thus forming a closed circuit, said control unit registers activation of said probe pairs and  
10   said control unit is designed to actuate at least one pre-determined response, said response being dependent on the order in which each of said probe pairs is activated.

**0013** According to another embodiment of the invention, a toy is provided comprising a cavity, at least one aperture in the toy associated with the cavity, a device housed within said cavity comprising: a conduit having at least one opening, a plurality of conductive probe pairs  
15   disposed within said conduit, a control unit coupled to said probe pairs and a power source to supply said control unit with power, wherein each of said probe pairs is activated when bridged by a conductive liquid thus forming a closed circuit, said control unit registers activation of said probe pairs and said control unit is designed to actuate at least one pre-determined response, said response being dependent on the order in which each of said probe pairs is activated.

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## **BRIEF DESCRIPTION OF THE DRAWINGS**

**0014** These and other features of the embodiments of the invention will become more apparent in the following detailed description in which reference is made to the appended drawings  
25   wherein:

**0015** Figure 1 is a perspective view, partially cut-away, of a device that emits various sounds in response to the activation of specific probes in a specific order.

**0016** Figure 2 is a sectional side view of a doll with the device of Figure 1.

**0017** Figure 3 is an elevated plan view, partially cut-away, of the doll of Figure 2.

**0018** Figure 4 is a perspective view of the doll of Figure 2 showing the positioning of the device.

**0019** Figure 5 is a sectional side view of a doll with an alternate embodiment of a device that  
5 emits various sounds or actuates a pump in response to the activation of specific probes in a specific order.

**0020** Figure 6 is a perspective view of part of the device contained in the doll of Figure 5.

**0021** Figure 7 is a sectional back view of the doll of Figure 5.

## **10 DETAILED DESCRIPTION OF THE EMBODIMENTS**

**0022** In the following description, numerous specific details are set forth to provide a thorough understanding of the invention. However, it is understood that the invention may be practiced without these specific details. In the description and drawings, like numerals refer to like structures.

**0023** It must be noted that as used herein and in the appended claims, the singular forms "a", "an" and "the" include the plural referents unless the context clearly dictates otherwise. Thus, for example, reference to "a probe" includes reference to one or more devices and equivalents thereof known to those skilled in the art, and so forth. The term "probe" is to be understood as any conductive electrical contact.

**0024** The invention is described in numerous instances to be activated by water. It is to be understood that in these instances, any suitable conductive liquid may be used. Furthermore, since pure water is generally non-conductive, the term "water", as used herein, is to be understood to be tap water or any other compositions or types of water that have the requisite conductive properties to complete a closed circuit.

**0025** References to orientation such as, but not limited to, "top", "bottom", "under", and "over" when used in connection with a doll assumes the doll is in a vertical position with the head at the top and the feet at the bottom, unless the context dictates otherwise.

0026 References to activation of certain probes is to be understood to mean the activation of a probe pair, consisting of any two of said probes, resulting from a conductive liquid completing a closed circuit between the pair of probes. For example, activation of probes A, B and C is to be understood as the completion of a circuit, by a conductive liquid, by contacting simultaneously  
5 any of A and B, B and C, or A and C.

0027 Referring to Figure 1, a device 100 is shown according to one aspect of the invention. The device 100 comprises a housing 15, batteries 6, control unit 7, speaker 5, and first to fourth probes 8, 9, 10, 11. One example of a control unit 7 is an integrated circuit board containing a memory. The housing 15 further comprises a housing ridge 17, a housing body 18 and an effect  
10 portion 19. First to fourth probes 8, 9, 10, 11 can form a probe pair with any other probe 8, 9, 10, 11 to complete a circuit. In the following description, first and second probes 8, 9 form a first probe pair; second and third probes 9, 10 form a second probe pair and third and fourth probes 10, 11 form a third probe pair. It is understood by those skilled in the art that other combinations of probe pairs are possible. The probes 8, 9, 10 and 11 are conductive. The probes 8, 9, 10, 11  
15 are coupled to the control unit 7. Probes 8, 9, 10, 11 are disposed into the housing 15 such that a tip of the probe is exposed on the exterior of the outer surface of the housing 15. The speaker 5 is coupled to the control unit 7. The speaker 5 is housed in the effect portion 19 of the housing 15 such that the speaker 5 is exposed and sound emitted from the speaker 5 is not obstructed. In one embodiment of the invention, the housing 15 is designed such that the control unit 7 and batteries  
20 6 have minimal exposure to water when the device 100 is submerged in water. This requires a water-resistant housing 15 and water resistant seals at junctions between the probes 8, 9, 10, 11 and the housing 15, between the speaker 5 and the housing 15, and between different portions of the housing 15 such as the housing ridge 17, the housing body 18, and the effect portion 19.

0028 In operation, the batteries 6 supply power to the control unit 7. The control unit 7 is  
25 operationally disposed to register the activation of probe pairs by a conductive liquid. Activation of a pair of probes by water, or another suitable conductive liquid, is achieved by the water simultaneously contacting both probes in a pair, and completing a circuit. The control unit 7 is further disposed to actuate a pre-determined response depending on the sequence in which each of the probe pairs is activated. Therefore, actuation of pre-determined responses depends on a  
30 logic resident on the control unit 7. For example, if water activates a first probe pair and then a

second probe pair, a first response would be actuated. However, if water activates the second probe pair and then the first, a different response would be actuated. Similarly, specific sequences of deactivation of activated probe pairs (or combinations of activations and deactivations) can also signal different responses. Deactivation of a probe pair occurs when a previously activated probe pair is no longer activated because the conductive liquid no longer bridges that probe pair to form a closed circuit. In this embodiment of the invention, the control unit 7 is designed to emit different sounds via the speaker 5.

**0029** It will be understood by those skilled in the art that responses other than sound can be produced upon activation of the control unit 7. Examples of other responses include the emission of light through a light emitter or movement using a motor.

**0030** Referring to Figures 2 and 3, a doll 200 housing the device 100 is shown. The doll 200 comprises a head 22, arms 14, legs 21 and a body 23. The body 23 comprises a cavity 16 and first to third apertures 2, 3, 4 in the doll associated with the cavity 16. In one embodiment of the invention, the cavity 16 further comprises a cavity ridge 20 on the inside of the doll's body that forms a ring with an axis parallel to the vertical axis of the doll. Each leg 21 contains a foot hole 1. The device 100 is disposed in the cavity 16 such that the cavity 16 is partitioned into first and second compartments 12, 13. In one embodiment of the invention, the ridge portion 17 and the cavity ridge 20 are coplanar and serve to form a liquid resistant partition between the first and second compartments 12, 13. The effect portion 19 is disposed within the second compartment. Second and third apertures 3, 4 are disposed within the second compartment.

**0031** The doll may be played with both out and in water, such as in a bathtub or swimming pool. In operation, vertically dunking the doll feet first in water will cause water to enter through the first aperture 2 and fill up the first compartment 12. As water fills up the compartment, the first probe pair is activated and then the second probe pair. This sequence triggers the control unit 7 to actuate a specific response such as emitting a sound from speaker 5 that emulates the sound of a baby playing in water. As water further rises and activates the third probe pair, this sequence may signal the control unit to emit a sound from speaker 5 that emulates the sound of a baby crying because the water is too deep. If the doll is turned onto its front, the first probe pair and second probe pair will be deactivated while the third probe pair is still activated. This

specific sequence of activation and deactivation signals another alternate response such as the emission from the speaker 5 of a sound emulating a baby swimming. As the doll is lifted out of the water, water will drain out from the first aperture 2 and the third probe pair will be deactivated first. Second and first probe pairs will be deactivated accordingly from the top of the doll to the bottom. This sequence of deactivation will again trigger a specific pre-determined response from the doll such as emitting various sounds from the speaker 5. For example, when the control unit 7 has registered that the third probe pair and then the second probe pair are deactivated, the doll emits a "swimming was fun" sound. When the control unit 7 registers the further deactivation of the first probe pair, the doll emits an "all done" sound.

**0032** In the embodiment of the invention where there exists a liquid-resistant partition between the first compartment 12 and the second compartment 13, water entering the first compartment 12 through the first aperture 2 will not result in water in the second compartment. As a result, the speaker 5 will not be submerged in water and sound emitted from the speaker 5 can resonate in the second compartment 13 and escape through second and third apertures 3, 4. Furthermore, the doll is designed to float upright in water by balancing the ratio of air, in the second compartment 13, head 22 and arms 14, to water in the first compartment 12 and legs 21. Water fills up the legs 21 by entering through the foot holes 1. It will be understood by those skilled in the art that other holes or apertures may be necessary to facilitate the flow of liquid into and within the doll 200.

**0033** Although the device 100 has been described as being housed within a doll, the device may also be housed in other toys. Examples of toys that are particularly suited for this type of water associated play include, but are not limited to, boats, water and sea creatures, pool toys, and submarines.

**0034** Referring to Figures 5, 6 and 7, another embodiment of the invention is shown. A doll 500 comprises a doll body 595 and a device 600. The doll body 595 comprises a head 522, torso 523, legs and arms. The head 522 comprises a head cavity 513 and first and second apertures 501, 502 in the head 522 and associated with the head cavity 513. The first aperture 501 corresponds to the mouth of the doll 500. The torso 523 comprises a torso cavity 512 and third and fourth apertures 503, 504 in the torso 523 and associated with the torso cavity 512. The head

522 is coupled to the torso 523 at a neck. The head cavity 513 and the torso cavity 512 thus form a larger combined cavity 516.

0035 The device 600 is housed within the doll body 595 and comprises a mouthpiece 550, a throat tube 551, a reservoir 553, an exit tube 554, a back tube 555, a pump tube 556 and a valve 590. The reservoir 553 further comprises a reservoir spout 552. The device 600 further comprises batteries 506, a control unit 507, a case 510, a speaker 505, a speaker housing 515, a pump 580 and first to tenth probes 531, 532, 533, 534, 535, 536, 537, 538, 539, 540. The pump further comprises a pump spout 557.

0036 The mouthpiece 550 is disposed in the first aperture 501, representing the mouth, and coupled to one end of each of the throat tube 551 and the pump tube 556. The throat tube 551 is oriented under the pump tube 556. The other end of the pump tube 556 is coupled to the pump 580. The other end of the throat tube 551 is coupled to the reservoir spout 552 of the reservoir 553. Sixth and seventh probes 536, 537 are disposed within the reservoir spout 552. The reservoir 553 is disposed approximately in the centre of the torso cavity 512. The bottom of the reservoir 553 is coupled to the exit tube 554. First to third probes 531, 532, 533 are disposed within the exit tube 554. The valve 590 controls the flow of liquid from the reservoir 553 to the exit tube 554. In one embodiment of the invention, the valve 590 is spring loaded, rests on the wall of the torso 523 and is in a closed position when at rest. Pressing on the torso 523 will push the valve into an open position allowing for the free flow of liquid from the reservoir 553 to the exit tube 554. The back tube 555 is coupled to a top portion of the reservoir 553 at one end and at the other end, coupled to the exit tube 554 above the first to third probes 531, 532, 533. Eighth to tenth probes 538, 539, 540 are disposed within the back tube 555.

0037 The throat tube 551, reservoir 553, and the exit tube 554 are oriented such that, when the doll is in a vertical position, water flows sequentially from one to the next when the valve is in an open position. The back tube 555 is oriented so that water does not flow into the back tube 555 from the reservoir 553 or from the exit tube 554, when the doll is in a vertical position.

0038 The control unit is coupled to the pump 580, the batteries 506, the speaker 505 and the first to tenth probes 531, 532, 533, 534, 535, 536, 537, 538, 539, 540. The pump spout 557 is disposed within the fourth aperture 504.



0039 The control unit 507 and the batteries 506 are housed within the case 510. The speaker 505 is housed within the speaker housing 515 which is designed so that the speaker 505 is able to emit sound unobstructed. In one embodiment of the invention, the speaker case 515 is disposed in the neck of the doll 500 such that the speaker 505 is disposed in the head cavity and such that the speaker case 515 forms a partition to physically separate the head cavity 513 and the torso cavity 512.

0040 In operation, movement of water through the device 600 will activate different probe pairs. The control unit 507 will register activation or deactivation of different probe pairs. The control unit 507 will then actuate different pre-determined responses based on the specific sequence of activation/deactivation of the probe pairs. The logic, namely the correlation between different probe pair activation/deactivation sequences and the pre-determined responses are pre-programmed into the control unit 507.

0041 For example, water, or any suitable conductive liquid, may be fed to the doll via the first aperture 501, the mouth. Water will enter the mouthpiece 550 and, in a typical feeding position, will flow primarily into the throat tube 551 since it is oriented under the pump tube 556. Water will proceed down the throat tube 551 into the reservoir spout 552 and thus activating a probe pair consisting of the sixth and seventh probes 536, 537. This activation is registered by the control unit 507. This will trigger a suitable sound, such as a drinking noise, to be emitted from the speaker 505. Sound from the speaker 505 resonates within the head cavity 513 and is allowed to escape through the second aperture 502. Water will continue to flow past the reservoir spout 552 and into the reservoir 553. The water will collect in the reservoir 553 since the valve 590 is in a closed position. Once the water has reached a certain level in the reservoir 553, the fourth and fifth probes 535, 534 will be activated and thus signal the control unit 507 to emit sound indicating the doll does not wish to drink anymore and would like to go to the bathroom. Pressing on the torso 523 of the doll will push the valve 590 into an open position. Water will then exit the reservoir 553 and flow into the exit tube 554. Flow of water within the exit tube 554 will activate probe pairs consisting of the first to third probes 531, 532, 533. This sequence of activation, namely fourth and fifth probes 534, 535 before first to third probes 531, 532, 533 will trigger the control unit 507 to emit a suitable wetting sound from the speaker 505. If after some feeding the doll 500 is placed in a horizontal position without releasing the valve 590, then water

will enter the back tube 555 and activate the eighth to tenth probes 538, 539, 540. This sequence of activation, namely the sixth and seventh probes and then the eighth to tenth probes, will trigger a sleeping baby sound.

5     **0042** The feeding scenario is contrasted with the situation where the doll is submerged in water. Submersion will cause probe pairs consisting of first to third probes 531, 532, 533, to be activated. As there is no prior activation of the fourth and fifth probes 534, 535, the control unit 507 will not cause a wetting sound, but rather an initial water play noise such as "water!"

10     **0043** As the doll is further submerged, water will travel up the exit tube 554 and into the back tube 555. Water will thus activate the eighth and ninth probes 538, 539 which is registered by the control unit 507. The control unit 507 will then actuate an appropriate response through the speaker 505, indicating that the doll has reached its preferred play depth, such as a singing sound. Subsequent intermittent activation of seventh and eighth probes, registered by the control unit 507, indicates that the doll is bobbing or floating in the water. As a result, the control unit 507 will cause a giggling sound to be emitted. As the doll 500 is further submerged, the  
15     additional activation of the tenth probe 540, in addition to the eighth and ninth probes 538, 539 will cause the control unit 507 to actuate the pump 580. The pump will cause water to be drawn in through the fourth aperture 504 and to be expelled through the pump tube 556 and out the mouthpiece 550. This causes the doll to expel water. Similarly, when the doll 500 is placed horizontally in water in a back float position, the same sequence of probe pair activation will  
20     occur, thus actuating the pump 580. Therefore, although the eighth to tenth probes are similarly activated in the dunking scenario as compared to the feeding scenario, different responses are triggered depending on which probes were activated prior.

25     **0044** It will be understood by those skilled in the art that other responses other than sound can be actuated by the control unit 507. Examples of other responses include the emission of light through a light emitter or movement using a motor. Similarly, although the device 600 has been described as being housed within a doll, the device may also be housed in other toys.

**0045** Although embodiments of the invention have been described herein, it will be understood by those skilled in the art that variations may be made thereto without departing from the spirit

of the invention or the scope of the appended claims. Furthermore, it will be understood by those skilled in the art that the embodiments described herein may be combined in any logical manner.